ATTACHMENT D – MAPS AND CROSS SECTIONS OF USDWS (PROPOSED)

Instructions

This section identifies all underground sources of drinking water (USDW) within the Area of Review. For USDWs in the Area of Review, maps and cross sections indicating the vertical and lateral limits of each USDW and its position relative to the injection formation and the direction of water movement, where known, are required.

USDWs

An aquifer is defined as "a geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring" (40 CFR 146.3). The Area of Review is located in the Elk Hills oil field boundary (**Exhibit D-1**). It is a hot, dry environment where evaporation exceeds precipitation every month of the year. Stream channels, which are dry nearly year round, cannot support fresh alluvial aquifers in this area to be considered as an USDW.

There are no USDWs within the Area of Review based on the following information:

1. The injection formation (Tulare) is an exempted aquifer within the Elk Hills oil field (Class II injection) because it is an oil and gas producing aquifer within the Elk Hills field as identified in the California Oil and Gas Fields (Volume I). The exemption is included in the "Underground Injection Control Program Memorandum of Agreement Between California Division of Oil and Gas and the United States Environmental Protection Agency Region 9", dated September 28, 1982.

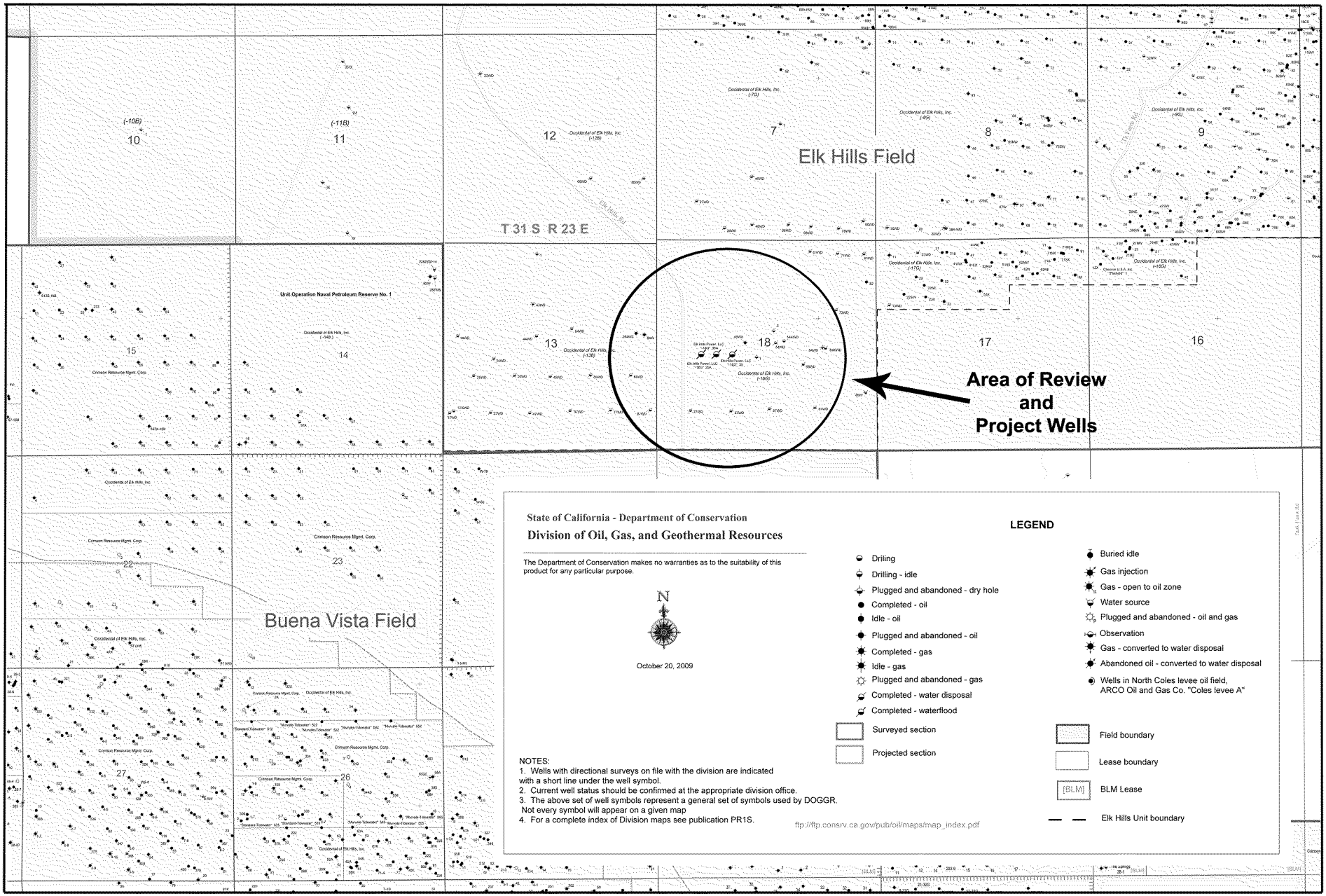
2. There are ten active Class II UIC wells disposing of oil field wastewater into the Tulare formation located in the project AOR (see **Exhibit B-3**). These wells are 85WD-13B, 87WD-13B, 27WD-18G, 37WD-18G, 54WD-18G, 54XWD-18G, 56WD-18G, 57WD-18G, 64XWD-18G and 67WD-18G.

3. The Tulare formation is also an exempted aquifer in the Buena Vista oil field to the immediate south and to the west of the project AOR.

4. The total dissolved solids (TDS) content of the groundwater is more than 3,000 and less than 12,000 milligrams per liter (mg/l) or parts per million (ppm) and it is not reasonably expected to supply a public water system (see **Exhibit A-1, Attachment 13**).

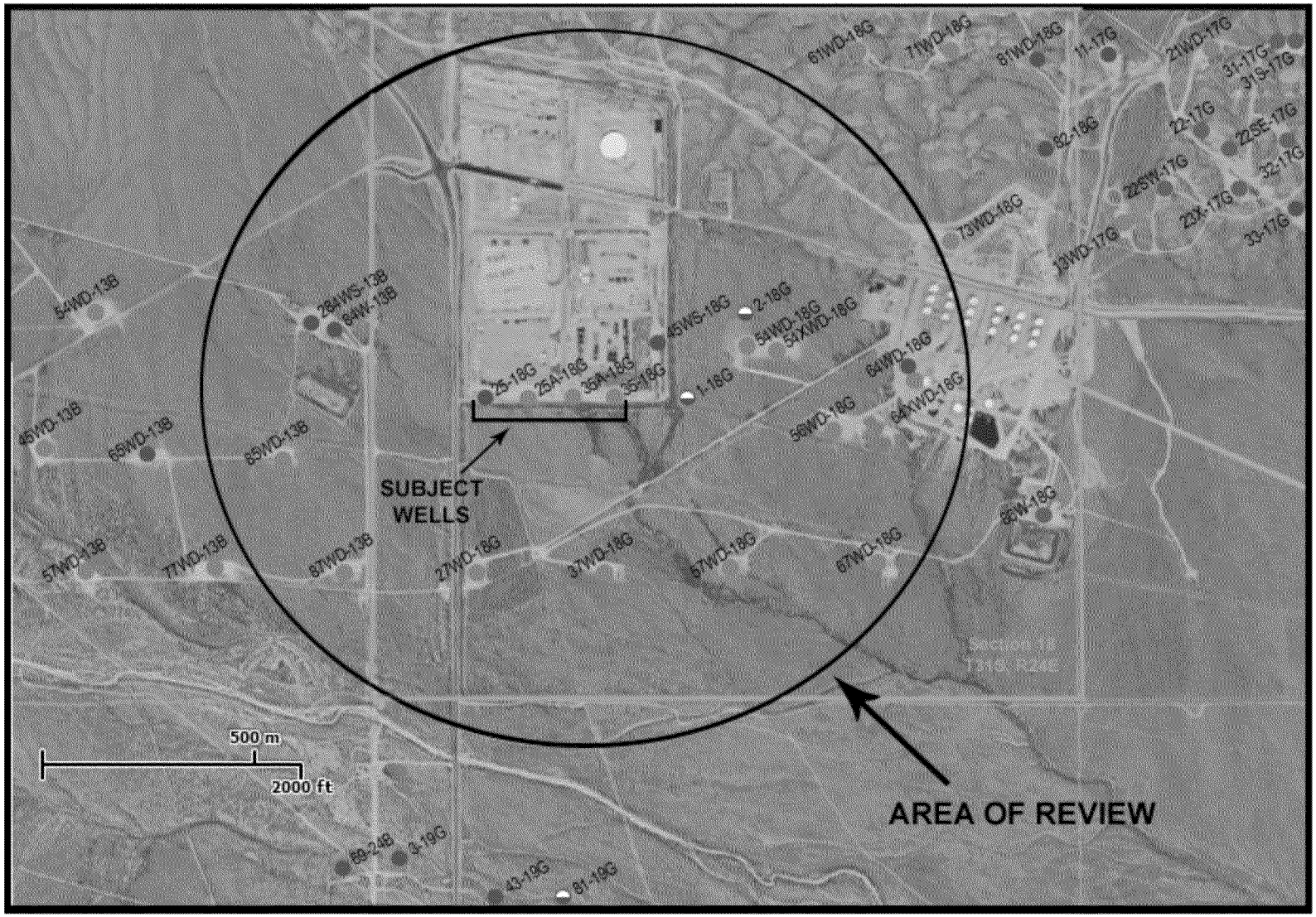
During the original UIC application review for the permitting wells, the EPA reached the same conclusion with regard to the Tulare Formation in the AOR. The EPA, in responding to a comment, stated "that the Tulare formation within the Area of Review is an exempted aquifer" and is therefore not protected as an USDW (EPA Region IX, Underground Injection Control Program, Class I Nonhazardous Waste Injection Draft Permit No. CA20002, Response to Comments, page 3, February 16, 2001, **Exhibit D-2**).

Map Showing Location of Area of Review within the Elk Hills Oil Field and Buena Vista Oil Field Boundaries



Composite of California Division of Oil, Gas, and Geothermal Resources Map 402, Map 403A, Map 420, and Map 421

Wells in Area of Review



California Division of Oil, Gas, and Geothermal Resources, Online Mapping System, December 2011

EPA Region IX
Underground Injection Control Program
Class I Nonhazardous Waste Injection Draft Permit No. CA200002

Response To Comments

February 16, 2001

Comment No. 1:
The commenter suggested that not all of the technical information about the well site is known prior to the drilling the of actual well and without this information, the issuance of the permit is premature.

Response No. 1:
The U.S. Environmental Protection Agency (EPA) believes that sufficient information is available to make an informed permit determination. EPA has considered and addressed all concerns raised by 40 CFR § 146.14, both through the permitting process and through the draft permit conditions, in order to protect Underground Sources of Drinking Water (USDWs). Furthermore, the draft permit provides that EPA will not authorize injection (i.e., approval to operate the wells will not be granted) until all stipulated conditions have been met.

Comment No. 2:
The commenter believes it is necessary to determine the presence of USDWs within the Area of Review before the permit is issued. It is suggested that the Elk Hills Power Project (EHPP) drill seven wells to obtain an accurate assessment of the hydrogeology before a final permit is issued.

Response No. 2:
EPA concludes that for this case, requiring the drilling of peripheral wells to be neither prudent, nor protective for a number of reasons. First, the drilling and construction of additional wells near the proposed injection wells would introduce concern because of their close proximity to the injection operations. Peripheral wells introduce additional pathways for possible migration of fluids that are intended to be contained within the Tulare formation, the proposed injection zone. Second, while the construction of these wells would introduce concern regarding their operational usage and eventual closure, they would not the serve the intent of the permit, which is to prevent contamination from occurring at the point of the injection or within existing wells within the Area of Review. Third, the exact characterization of the possible USDW overlying the injection zone is not necessary in order to provide its protection. The draft UIC permit provides numerous and complementary protective measures to prevent the contamination of USDWs, whether or not USDWs exist within the area. Fourth, the use of well diagnostic technology, combined with operating, monitoring and testing practices allows for advance detection of possible contaminating situations and resulting remedial action(s) at the location of

the injection well.

Comment No. 3:
The commenter believes that EPA proposes to alter or modify important permitted well construction requirements after the close of public comment in violation of 40 CFR Part 124.
Response No. 3:
EPA may make minor modifications to permits under 40 CFR §144.41(f) to change construction requirements approved by the EPA Region 9 Director (Director) pursuant to 40 CFR §144.52(a)(1). Major modifications must be processed under the procedures of 40 CFR Part 124 and therefore must be public noticed.

Nonetheless, EPA acknowledges that draft permit condition "II.C.1.a.ii." may be read out of the intended context of minor modification to construction requirements as stipulated in conditions "II.A.3. Injection Intervals" and "II.A.5. Proposed Changes and Workovers." To address this concern, EPA has amended the draft permit condition II.C.a.(ii) to read "The Director may require minor modifications to the construction requirements based upon the information obtained during well drilling and related operations should the proposed casing setting depths not completely cover the base of the USDW." See enclosed copy of the draft permit.

Comment No. 4:
The commenter expressed the concern that the Tulare formation, which is the proposed injection zone, is not an exempt aquifer outside the boundaries of the Elk Hills oilfield and is therefore an USDW. It would be contaminated by off-site migration of injected fluids.
Response No. 4:
The Tulare formation is not an USDW outside of the boundaries of the Elk Hills field at this location because it is an exempted aquifer in the Buena Vista Front area of the Buena Vista oilfield, which directly adjoins the Elk Hills oilfield to the south. In addition, numerous calculations using a variety of waste plume geometries and formation characteristics have demonstrated that even under significantly less favorable conditions, the waste front will not migrate off-site.

Comment No. 5:
There is no discussion on compatibility of injectate with injection zone. The permittee should provide engineering estimates of expected chemical analysis of injectate and should consider concentration levels as compared to drinking water standards.
Response No. 5:
Compatibility of fluids is not expected to become a problem in this case because examination of waste streams from similar operations with similar permitted and geologic settings has shown no

problems associated with fluid compatibility. Compatibility of the Tulare formation fluid with the injectate is of concern to EPA because of the resulting high pressures that may be experienced from the plugging of the available pore space for fluid flow within the Tulare. The increase of injection pressures could cause fluids to migrate into USDWs through channels within the borehole or through hydraulic fracturing of the Tulare formation and the overlying confining layer. However, the permit conditions contain numerous and complementary protective measures, which include limiting the maximum allowable injection pressure to a value sufficiently below the pressure required to fracture the Tulare, periodic testing for leaks in the protective layers of casing, and periodically establishing that vertical fluid migration within or near the borehole does not exist. Therefore, the burden of preventing plugging of the Tulare formation's pore spaces is an ongoing operational issue for EHPP in order to avoid the injection pressure from approaching or exceeding the maximum allowable pressure.

Comment No. 6:
The commenter believes two USDWs will be potentially affected by the injection operation, in violation of 40 CFR § 144.12.

Response No. 6:
After review of the existing records, EPA has made the determination that the Tulare formation within the Area of Review is an exempted aquifer. As such, the prohibitions of 40 CFR §144.12(a) do not apply to the Tulare formation within the Area of Review. Furthermore, injection will be confined to the intended injection zone and no USDWs will be impacted by the permitted underground injection activities.

Comment No. 7:
The permittee should provide engineering estimates of expected chemical analysis of injectate and should consider concentration levels as compared to drinking water standards.

Response No. 7:
As discussed in Response No. 4, the Tulare formation is an exempted aquifer and is therefore not protected as an USDW. As a result, drinking water standards are not applicable. Therefore, a comparison of fluid analyses results (which are used to chemically characterize the waste stream) and drinking water standards is not appropriate in this case.

Comment No. 8:
No monitoring plans for analysis of injectate are included in the permit.

Response No. 8:
EPA agrees with this comment and has revised the permit Part II.D.1.(c) accordingly to require quarterly monitoring of injection fluids.

Comment No. 9:
The commenter asserted that one well within the Area of Review requires corrective action because it was not properly plugged and abandoned, it penetrates the injection zone and that its location is within the area of influence. Therefore, it is possible that injection fluids will migrate into a USDW at the location of this well.

Response No. 9:
Calculations conclusively show that the proposed injection into the Tulare formation will not cause fluid to rise to a level that will endanger USDWs at the location of the well in question. Therefore, corrective action is not necessary for this well.

Comment No. 10:
The commenter believes that an incorrect Area of Review was selected for the permit and that other States and Regions routinely use fixed radii of up to 2.5 miles.

Response No. 10:
EPA believes that the commenter mistakenly used Area of Review dimensions for Class I hazardous waste wells. The regulations at 40 CFR § 146.63 require that the Area of Review for Class I Hazardous waste injection must be a radius of no less than 2 miles. The UIC permit application is for two Class I Nonhazardous wells. The regulations at 40 CFR § 146.6 provide that the Area of Review may be determined by (a) calculation of the zone of endangering influence or (b) using a fixed radius, provided that a fixed radius of no less than 0.25 miles may be used.

Comment No. 11:
The EHPP did not use the Theis Equation, a mathematical model as required in 40 CFR §146.6(a)(2). Therefore the "area of influence" was not calculated correctly.

Response No. 11:
The Theis Equation is only one form of mathematical model which may be used as suggested in the regulations. The Warner & Lehr Equation used in the permit application is an acceptable model which uses parameters suggested in 40 CFR §146.6(a)(2).

Comment No. 12:
The draft permit reports the location of the wells in "Section 18, T.31 S., R.24 E, in Kern County, California." The draft permit should be revised to specify the latitude and longitude of the proposed wells.

Response No. 12:
EPA agrees with this comment and has revised the permit Part I accordingly.

Comment No. 13:
Potentially active faults exist along the southern flank of the Elk Hills located about 1,200 to 2,100 feet north of the proposed injection wells and crossing the proposed supply pipeline route.
Response No. 13:
EPA examined aerial photography and geologic literature and conducted a field reconnaissance to evaluate the possible presence of potentially active faults. Based on its investigations, EPA concluded that there was no evidence of faulting within the area.

Comment No. 14:
The commenter expressed concern regarding the ability of the Tulare clay to act as a positive barrier to wastewater migration.
Response No. 14:
Satisfactory evidence such as well logs and drilling records exists that the Tulare clay acts as a barrier to ground water flow and that it will act as a barrier to contain the injection fluids within the Tulare formation.

Comment No. 15:
EPA must comply with the requirements of section 7 of the Endangered Species Act ("ESA") because EPA's approval of the UIC permit application may affect species listed under the ESA as threatened or endangered.
Response No. 15:
Pursuant to section 7 of the Endangered Species Act, 16 U.S.C. § 1536, and its implementing regulations at 50 CFR Part 402, EPA is required to ensure that any action authorized, funded, or carried out by EPA is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of such species' designated critical habitat. EPA has determined that its UIC permitting action triggers its ESA section 7 obligations. EPA is therefore required to consult with the United States Fish and Wildlife Service ("FWS") and/or the National Marine Fisheries Service ("NMFS") if endangered species or threatened species may be present in the area affected by the UIC permit and EPA's action (i.e., permit issuance) may affect such species. EPA is also required to confer with FWS and/or NMFS on any action that is likely to jeopardize the continued existence of any species proposed for listing as endangered or threatened or result in the destruction or adverse modification of critical habitat proposed to be designated for such species.

When a federal action involves more than one federal agency, consultation and conference responsibilities under section 7 of the ESA may be fulfilled through a lead agency pursuant to 50 CFR § 402.07. The federal agencies involved with the Elk Hills Power Project designated the Bureau of Land Management ("BLM") as the lead agency. BLM and EPA initiated formal consultation with FWS regarding the Elk Hills Power Project on December 10,

1999. As part of this consultation, FWS issued a biological opinion on January 17, 2001 that discusses how the federal agency action affects each listed species and/or its designated critical habitat and sets forth all measures necessary or appropriate to avoid and/or minimize impacts on such species and critical habitat.

EPA has reviewed the biological opinion and determined that issuance of the final UIC permit is consistent with the requirements of the Endangered Species Act.

Comment No. 16:
EPA must comply with the requirements of section 106.of the National Historic Preservation Act ("NHPA") because EPA's proposal to issue a UIC permit is an "undertaking" as defined by the NHPA that has the potential to cause effects on historic properties.

Response No. 16:
Pursuant to section 106 of the National Historic Preservation Act, 16 U.S.C. § 470f, and its implementing regulations at 36 CFR Part 800, prior to the issuance of any license EPA must take into account the effect of its undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places, and must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertaking. EPA has determined that its UIC permitting action constitutes an "undertaking" as that term is defined in 40 CFR § 800.16(y). EPA is therefore required to: (1) consult with the appropriate State Historic Preservation Officer ("SHPO") to identify historic properties in the area of potential effects, and evaluate and resolve adverse effects on identified historic properties; and (2) identify other consulting parties to ensure adequate public involvement. EPA has satisfied its responsibilities under the National Historic Preservation Act at this time and may issue the final UIC permit.